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Flat sealing material in the form of a
reinforced composite film
Frenzelit-Werke GmbH & Co. KG
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Patent claims

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1. High-performance flat sealing material thermally stable under application conditions up to 330°C, in the form of a fibre-reinforced and/or binder reinforced composite film, having a total layer thickness of from 0.01 mm to 3 mm, producible by pressing at least one or more fibre webs, comprising the components:

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(a) at least one first fibre comprising a thermoplastic, selected from the group consisting of polyether ether ketone (PEEK), poly-p-phenylene sulphide (PPS), polyetherimide (PEI), polyetheramide (PEA), polyamide (PA), polysulphone (PSU), polyvinyl ether sulphone (PPSU), polyether sulphone (PES), polyaryl ether ketone (PAEK), polyether ketone (PEK), polyoxymethylene (POM) and mixtures thereof, or from the group consisting of metallic molten fibres having a melting or softening point of the metal fibres of less than 450°C, as molten fibres, in a proportion by weight of from 30 to 97%, based on the total formulation of the fibre web, and having a fibre length distribution of the molten fibres in the

- range of from 0.1 mm to 30 mm,
- (b) optionally at least one second reinforcing fibre, selected from the group consisting of glass fibres, aramid fibres, carbon fibres, ceramic fibres, oxidised polyphenylene sulphide (PPSO₂) fibres, metal fibres, polyimide fibres, polybenzimidazole fibres, polybenzoxazazole fibres and natural fibres and mixtures thereof, the thermal stability of which is greater than that of the molten fibres, in a proportion by weight from 3 to 67%, based on the total formulation of the fibre web, and a fibre length distribution of reinforcing fibres in the range of from 0.1 mm to 30 mm, with the proviso that the average fibre length distribution of the molten fibre is smaller than that of the reinforcing fibres,
- (c) up to 60 per cent by weight, in particular from 3 to 10% by weight, of a binder, based on the total formulation of the fibre web,
- the components (a), (b) and (c) summing in each case to 100% by weight, and
- (d) in addition to 100% by weight of the components (a), (b) and (c), optionally from 0.1 to 80 parts by weight of customary additives and compounding materials, selected from fibres, fibrils, fibrids, nanoscale additives in

- the size range from 5 to 300 nm, film-like structures, pulps, metallic or ceramic powders, or inorganic hollow microspheres having an average particle size of from 10 to 300 μm and a compressive strength of from 3.5 to 70 MPa and mixtures thereof, fibrid-like additives being preferred,
- under pressure and at a temperature which is above the melting point or softening point of the molten fibres to give a reinforced composite film having a total layer thickness of 0.01 mm to 3 mm.
2. Flat sealing material according to Claim 1,
characterized in that the pressing has been carried out at a pressure of from 0.05 to 15 N/mm² and a temperature of up to 450°C.
3. Flat sealing material according to Claim 1 or 2,
characterized in that the individual fibre webs or fibre mats have a weight per unit area of from 8 to 400 g/m², in particular of from 50 to 100 g/m².
4. Flat sealing material according to Claims 1 to 3,
characterized in that the molten fibre is selected from the group consisting of PPS, PEI, PEK and PEEK and blends thereof and from the group consisting of the metallic molten fibres.
- 30 5. Flat sealing material according to any of Claims 1 to 4, characterized in that the binder (c) is fibrous and/or film-like and/or fibrid-like and in particular is a dispersion and contains compounds

which are based on polyacrylate, polyvinyl acetate, ethylene/vinyl acetate, polyvinyl alcohol, polyurethanes, polyaramids, (co)polyolefins, resins from the group consisting of melamine resins, phenol resins, polyurethane resins, or mixtures thereof.

- 5 6. Flat sealing material according to Claim 1, characterized in that tribologically active compounding materials known from the prior art, such as PTFE fibres or powders, polyimide fibres, polyaramid fibres or films and/or fibrils, carbon nanofibres or powders, are present as additives in the flat sealing material.
- 10 15 7. Flat sealing material according to any of Claims 1 to 6, characterized in that the flat sealing material after pressing or consolidation has a density of from 0.25 g/cm³ to 4 g/cm³, in particular from 0.75 g/cm³ to 1.6 g/cm³.
- 20 25 8. Fibre composite material according to any of Claims 1 to 7, characterized in that the molten fibres, the additives and the reinforcing fibres are present in homogeneous distribution in the fibre mat.
- 30 9. Fibre composite material according to any of Claims 1 to 8, characterized in that it has a specific inhomogeneity in cross-section.
10. Seal, in particular cylinder head gasket, characterized in that it consists of a flat

sealing material according to any of the preceding
Claims 1 to 9 and is optionally applied to at
least one sheet-like substrate, in particular a
metallic substrate, or a woven fabric or knitted
fabric, or paper or a sheet.

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11. Seal according to Claim 10, characterized in that
the flat sealing material is embedded between two
substrates, in particular two woven fabric
10 substrates.

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12. Seal according to Claim 10, characterized in that
it consists of a laminate comprising a plurality
of flat sealing materials applied to substrates.

13. Seal according to any of Claims 10 to 12,
characterized in that it has a density varying
from place to place or a topographical surface or
thickness varying from place to place.

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14. Seal according to Claim 13, characterized in that
the different resilience and plasticity are
achieved by topographically designed press plates
or partial, sectoral pressing with compression
25 pressures varying from place to place.

15. Seal according to Claims 10 to 14, characterized
in that it has a topographical surface which
varies from place to place and has been achieved
30 by means of a top material layer which is
adhesively bonded or welded to the seal, in
particular is welded by means of laser technology.

16. Seal according to any of the preceding Claims 10 to 16, characterized in that the different resilience and plasticity have been achieved by different fibre and/or filler content within the sealing surfaces.
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17. Seal according to any of Claims 10 to 16, characterized in that the different resilience and plasticity are distributed in sectors over the sealing surface and are achieved by mosaic-like assembly of the fibre mats of different resilience and plasticity.
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18. Seal according to any of Claims 10 to 17, characterized in that the flat sealing material used for the seal has different resilience and plasticity and the seal contains both composite materials, inserted elastomer parts, ceramic materials and metallic materials, such as bead rings, sheet metal rings placed on top or inserted, sheet metal rings without beading, flanged borders or reinforced films which have been welded on or applied by adhesive bonding.
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- 25 19. Seal according to any of Claims 10 to 18, characterized in that additives have been applied in a localised manner to the fibre webs in a separate operation by spraying, gravure printing or screen printing.
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20. Seal according to any of Claims 10 to 19, characterized in that additives have been applied in a localised manner to the reinforced film in a

separate operation by spraying, gravure printing or screen printing.

21. Seal according to any of Claims 10 to 20,
5 characterized in that additives have been applied in a localised manner to the seal in a separate operation by spraying, gravure printing or screen printing or by laser technology.
- 10 22. Seal according to any of Claims 10 to 21, characterized in that the seal has a sealing geometry produced by moulding.
- 15 23. Seal according to any of Claims 10 to 22, characterized in that the seal has a comb profile for sealing.
- 20 24. Seal according to any of the preceding Claims 10 to 23, characterized in that it contains sensors or transponders which have been incorporated by means of the pressing process.